

THE ROCKEFELLER UNIVERSITY

1230 YORK AVENUE

NEW YORK, NY 10021

December 22, 1989

JOSHUA LEDERBERG

PRESIDENT

Dr. John A. Moore ${\mathcal V}$ Department of Biology University of California Riverside, California 92521

Dear Johnny:

As I think I may have mentioned in some of our correspondence, I gave a lecture at Woods Hole during summer 1988 on the idea of the linkage map: very appropriately since it was the Morgan Sturtevant Memorial Lecture. You may also have surmised that I have borrowed very heavily from your work for the earlier part of my talk.

The MBL is now preparing to publish those talks and I am writing to ask you a considerable favor to help us get out with the book: that is with regard to the figures. I am enclosing a number of the ones that I used as transparencies in my discussion and what I would like to ask of you is whether -- especially for the photographs -- you could provide prints that would be more suitable for including in the manuscript for publication. We would also like to request your approval for the reprinting, which will assist the Harvard University Press when they go through the systematic legal form.

With our very best wishes for the season and for the New Year,

Yours sincerely,

Joshua Lederberg

Encls. 5 transparances
P373 plus Brekure (On Res.)

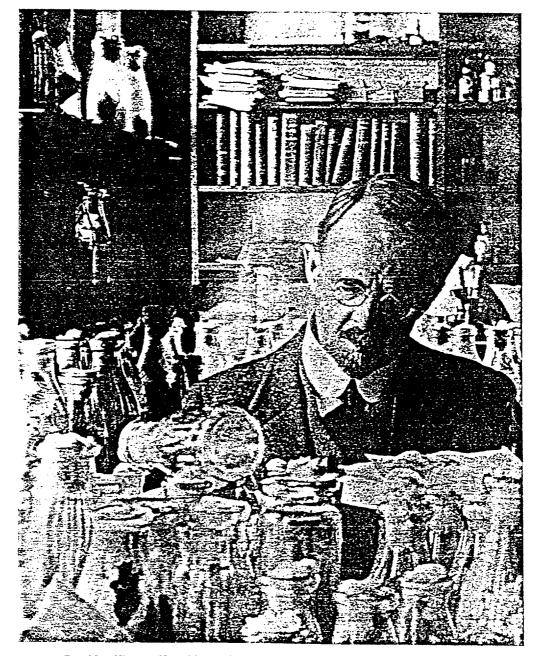


Fig. 29. Thomas Hunt Morgan in the Fly Room, Taken about 1917 by Calvin Bridges.

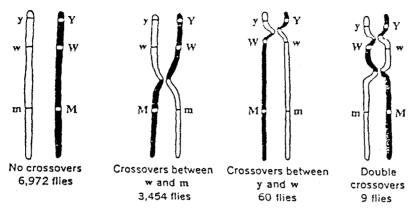
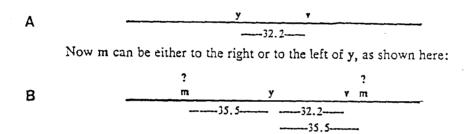


Fig. 38. Sturtevant's experiment. See text for details.



С	<u>y· w</u>		▼	m	r
	0.0 1.0	,	30.7	33.7	57.6

Fig. 37. Sturtevant's method for determining the linear order of gene loci. A shows y and v separated by a distance equal to the percentage of crossing-over between them. B shows the percentage of crossing-over between y and m and the impossibility of knowing whether m is on the side with v or not. C shows the relative position of five loci on the X chromosome.

つ。 ハ ハ ハ ハ ハ ハ ハ ハ

Name Region Affected Abnormal Abdomen Antlered Wing Bar Eye Apterous Wing Bifid Venation Arc Wing Bow Wing Balloon Venation Cherry Eye color Black Body color Chrome Body color Blistered Wing Cleft Venation Comma Thorax mark Club Wing Confluent Venation Depressed Wing Cream II Eye color Dachs Legs Desin Eye Jaunty Wing Wing Wing Wing Wing Wing Wing Wing	c	ROUP I	GROUP II			
Bar Eye Apterous Wing Bifid Venation Arc Wing Bow Wing Balloon Venation Cherry Eye color Black Body color Chrome Body color Blistered Wing Cleft Venation Comma Thorax mark Club Wing Confluent Venation Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Eosin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Spoon Wing Name Region Affected Spot Body color Deformed Eye Vermilion Eye color Dwarf Size of body Yellow Body color Fan Antenna Beaded Wing Furple Eye color Office Body Color Fruncate Wing Cream III Eye color Office Wing Size of body Kidney Eye Low crossing over III chromosome Figure Size of body Kidney Eye Fink Eye color Rough Eye Sofranin Eye color Rough Eye Sofranin Eye color Softy Body color Spineless Spines Spines Spread Wing Firdent Pattern Frident Frident Pattern Frident Frid	Name	Region Affected	Name	Region Affected		
Bar Eye Apterous Wing Bifid Venation Arc Wing Bow Wing Balloon Venation Cherry Eye color Black Body color Chrome Body color Blistered Wing Cleft Venation Comma Thorax mark Club Wing Confluent Venation Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Eosin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Spoon Wing Name Region Affected Spot Body color Deformed Eye Vermilion Eye color Dwarf Size of body Yellow Body color Fan Antenna Beaded Wing Furple Eye color Office Body Color Fruncate Wing Cream III Eye color Office Wing Size of body Kidney Eye Low crossing over III chromosome Figure Size of body Kidney Eye Fink Eye color Rough Eye Sofranin Eye color Rough Eye Sofranin Eye color Softy Body color Spineless Spines Spines Spread Wing Firdent Pattern Frident Frident Pattern Frident Frid	Abnormal	Abdomen	Antlered	Wing		
Bifid Venation Arc Wing Balloon Venation Cherry Eye color Black Body color Chrome Body color Blistered Wing Cleft Venation Comma Thorax mark Club Wing Confluent Venation Venation Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Confluent Venation Comma Thorax mark Club Wing Cream II Eye color Dotted Thorax Curved Wing Confluent Venation Comma Thorax mark Clurved Wing Cream II Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Wing Furrowed Eye Jaunty Wing Wing Fused Venation Limited Abdominal band Ittle crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Rudimentary Wings Trefoil Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Skee Wing Spoon Wing Spoon Wing Spoon Wing Spoon Wing Spoon Body color Band Pattern Truncate Wing Cream III Eye color Deformed Eye Color Dwarf Size of body Yellow Body color Ebony Body color Ebony Body color Eye color Dwarf Size of body Kidney Eye Color Pink Eye color Pink Eye color Pink Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern Pattern	Bar	Eye	Apterous			
Cherry Eye color Chrome Body color Chrome Body color Cleft Venation Comma Thorax mark Club Wing Confluent Venation Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Essin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Spoon Wing Rody Color Deformed Eye Wing Cream III Eye color Skee Wing Spoon Body color Deformed Eye White Eye color Deformed Eye Wing Safranin Eye color Fooly Body color Fool Bendy Eye Low crossing over III Chromosome Maroon Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spi	Bifid	Venation	Arc	-		
Chrome Body color Cleft Venation Comma Thorax mark Club Wing Confluent Venation Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Eosin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Furrowed Eye Jaunty Wing Morula Ommatidia Email I Chromosome Jaunty Wing Morula Ommatidia Demonstration Officen Body color Office Body color Lethals, 13 Die Plexus Venation Limited Abdominal band I Chromosome Morula Ommatidia Demonstration Office Body color Deformed Eye Color Strap Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Wing Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Venation Vestigial Wing Short Wing Spoon Wing GROUP III Spoon Wing Spot Body color Deformed Eye Color Deformed Eye Color Office Eye color Deformed Eye Color Eye Color Eye Color Eye Color Eye Color Sooty Body Color Spineless Spines Spin	Bow	Wing	Balloon	Venation		
Cleft Venation Comma Thorax mark Club Wing Confluent Venation Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Eosin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing Short Wing Short Wing Short Wing Spoon Wing GROUP III Name Region Affected Bent Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Deformed Eye Low crossing over III chromosome Fye color Dwarf Size of body Fyellow Body color Forman Antenna Beaded Wing Find Pattern Find Pattern Find Pattern Find Pattern Fye color Fyelor Body color Forman Fye color Fyelow Body color Fyelow Fye	Cherry	Eye color	Black	Body color		
Club Wing Confluent Yenation Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Eosin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoll Pattern Sable Body color Truncate Wing Short Wing Short Wing Short Wing Spoon Wing GROUP III Size of body Synol Body color Deformed Eye Vermilion Eye color White Eye color Davarf Size of body Yellow Body color Ebony Body color GROUP IV Name Region Affected Bent Wing Maroon Eye color Spineless Spines	Chrome	Body color	Blistered	Wing		
Depressed Wing Cream II Eye color Dotted Thorax Curved Wing Eosin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Furrowed Eye Jaunty Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Short Wing Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Name Region Affected Bent Wing Maroon Eye color Eye color Pink Eye color Sooty Body color Spines Spines Spines Spread Wing Trident Pattern	Cleft	Venation	Comma	Thorax mark		
Dotted Eosin Eye color Dachs Legs Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fured Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Short Wing Short Wing Short Wing Spoon Wing Spoon Wing Spoon Wing Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Deformed Eye White Eye color Deformed Eye Wing Region Affected Bent Wing Maroon Eye color Fink Eye color Sooty Body color Sopines Spines Spines Spines Spines Spines Spines Spines Spread Wing Trident Pattern	Club	Wing	Confluent	Venation		
Eosin Eye color Dachs Legs Facet Ormatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Short Wing Short Wing Short Wing Short Wing Spoon Wing Spoon Wing Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color GROUP IV Name Region Affected Bent Wing Maroon Eye color Pink Eye color Sooty Body color Sopines Spines Spines Spines Spread Wing Trident Pattern	Depressed	Wing	Cream II	Eye color		
Facet Ommatidia Extra vein Venation Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing Skee Wing Spoon Wing Name Region Affected Spot Body color Band Pattern Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Spineless Spines Spines Spread Wing Trident Pattern Pattern	Dotted	Thorax	Curved	Wing		
Forked Spines Fringed Wing Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Short Wing Spoon Wing Spoon Wing Spoon Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Name Region Affected Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Soptia Eye color Sopty Body color Spines Spread Wing Trident Pattern	Eosin	Eye color	Dachs	Legs		
Furrowed Eye Jaunty Wing Fused Venation Limited Abdominal band Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing Skee Wing GROUP III Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Low crossing over III chromosome Rough Eye color Pink Eye color Pink Eye color Pink Eye color Spote Soft Eye Peach Eye color Soft Spoines Spines Spread Wing Trident Pattern	Facet	Ommatidia	Extra vein	Venation		
Fused Venation Green Body color Jaunty Wing Morula Ommatidia Lemon Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Short Wing Short Wing Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color GROUP IV Name Region Affected Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	Forked	Spines	Fringed	Wing		
Green Body color Little crossover II chromosome Jaunty Wing Morula Ommatidia Lemon Body color Olive Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Skee Wing Ming GROUP III Sphot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color White Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color Giant Size of body Kidney Eye Color Pink Eye color Pink Eye color Pink Eye color Pink Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	Furrowed	•	-	Wing		
Jaunty Wing Morula Ommatidia Lemon Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Short Wing Skee Wing GROUP III Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Sooty Body color Sooty Body color Sooty Body color Sooty Body color Spineless Spines Spread Wing Trident Pattern	Fused		Limited	Abdominal band		
Lemon Body color Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing Skee Wing GROUP III Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Bent Wing Maroon Eye color Eye ecolor Peach Eye color Rough Eye Safranin Eye color Rough Eye Safranin Eye color Spineless Spines Spineless Spines Spineless	Green	•		II chromosome		
Lethals, 13 Die Plexus Venation Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing GROUP III Skee Wing Name Region Affected Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Peach Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spineless Spineless Spineless Spread Wing Trident Pattern	Jaunty	=		Ommatidia		
Miniature Wing Purple Eye color Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Skee Wing GROUP III Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Giant Size of body Yellow Body color Eyeny Body color GROUP IV Kidney Eye Low crossing over III I chromosome Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Spineless Spines Spineless Spines Spread Wing Trident Pattern				•		
Notch Venation Speck Thorax mark Reduplicated Eye color Strap Wing Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing GROUP III Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Rough Eye Safranin Eye color Spineless Spines Spinelss Spinelss Spinelss Spinelss Spinelss Spinelss Spinelss Spinelss Spinelss Spinels Spinels Spinelss Spinels Spinels Spinelss Spinels S						
Reduplicated Eye color Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing GROUP III Skee Wing Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Bent Wing Maroon Eye color Eye low crossing over III chromosome Eyeless Eye Peach Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern		•	•	•		
Ruby Legs Streak Pattern Rudimentary Wings Trefoil Pattern Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing Short Wing GROUP III Skee Wing Name Region Affected Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Giant Size of body Kidney Eye Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern						
Rudimentary Sable Body color Shifted Venation Short Wing GROUP III Name Region Affected Spoon Wing Truncate Wing Cream III Eye color Vermilion Eye color White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Size of body Kidney Eye Low crossing over III chromosome Eye color Eye color Pink Eye color Pink Eye color Sooty Sooty Sooty Sooty Sooty Sooty Spineless Spines Spread Wing Trident Pattern	•		•	•		
Sable Body color Truncate Wing Shifted Venation Vestigial Wing Short Wing Skee Wing Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Giant Size of body Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Sooty Body color Spineless Spines Spread Wing Trident Pattern	•	_				
Shifted Venation Vestigial Wing Short Wing Skee Wing Spoon Wing Spoon Wing Spot Body color Tan Antenna Beaded Wing Truncate Wing Truncate Wing Truncate Eye color Vermilion Truncate Eye color Vermilion Truncate Eye color White Eye color Tellow Tolor GROUP IV Tolor Group Tolor GROUP IV Tolor Group Tolor Feye Tolor Feye Tolor Sooty Tolor To	-	<u>~</u>				
Short Wing Skee Wing Spoon Wing Spoon Wing Spot Body color Tan Antenna Truncate Wing White Eye color Yellow Sody Safranin Eye color Eye less Spon Sody Safranin Size color Sooty Spineless Spines Spines Spread Wing GROUP III SROUP III Speciol Affected Specular Affected Specior Spineless Spines Spi		•		_		
Skee Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Giant Size of body Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern			Vestigial	Wing		
Spoon Wing Name Region Affected Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Giant Size of body Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eye color Pink Eye color Rough Eye Safranin Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern		<u>-</u>	CROUP III			
Spot Body color Band Pattern Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern		~				
Tan Antenna Beaded Wing Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Giant Size of body Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	•	•		· ·		
Truncate Wing Cream III Eye color Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	•	•				
Vermilion Eye color Deformed Eye White Eye color Dwarf Size of body Yellow Body color Ebony Body color GROUP IV Giant Size of body Kidney Eye Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Spinelss Spines Spread Wing Trident Pattern				_		
White Eye color Yellow Body color GROUP IV Name Region Affected Low crossing over Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Spineless Spines Spread Wing Trident Size of body Kidney Eye Eye III chromosome Eye color Eye color Eye color Sooty Body color Spines Spread Wing Pattern		•		•		
Yellow Body color GROUP IV Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern		<u>-</u>				
GROUP IV Name Region Affected Eye Low crossing over Hil chromosome Eye color Eyeless Eye Peach Pink Eye color Rough Eye Safranin Eye color Sooty Spineless Spines Spines Spread Wing Trident Size of body Eye Eye Eye III chromosome Eye color Eye color Sooty Spineless Spines Spines Spines Spines Spines		-		-		
Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	Tellow	Body color	•	•		
Name Region Affected Low crossing over III chromosome Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	. G	ROUP IV		•		
Bent Wing Maroon Eye color Eyeless Eye Peach Eye color Pink Eye color Rough Eye Safranin Eye color Sepia Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	Name	Region Affected	_	•		
Eyeless Eye Peach Pink Eye color Rough Eye Safranin Eye color Sepia Eye color Sooty Spineless Spines Spread Wing Trident Pattern	*	•	_			
Pink Eye color Rough Eye Safranin Eye color Sepia Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern				•		
Rough Eye Safranin Eye color Sepia Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern	Lycicss	_,,,	· · · · · · · ·			
Safranin Eye color Sepia Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern						
Sepia Eye color Sooty Body color Spineless Spines Spread Wing Trident Pattern						
Sooty Body color Spineless Spines Spread Wing Trident Pattern	Q	♂				
Spineless Spines Spread Wing Trident Pattern	4 4	4 .	•			
Spread Wing Trident Pattern	<i></i>	// 1	-	•		
Trident Pattern				•		
11			•			
Truncate intensi. Wing	/\	11	Truncate intensf.	Wing		
Whitehead Pattern	/ N	1 3	Whitehead	Pattern		
X X X T White ocelli Simple eye	X_X	χī	White ocelli	Simple eye		

Fig. 35. The linkage groups of Drosophila melanogaster as known in 1915. The 85 genes fell into 4 linkage groups. The diagram at the lower left shows the chromosomes in somatic cells. (Morgan, 1915)

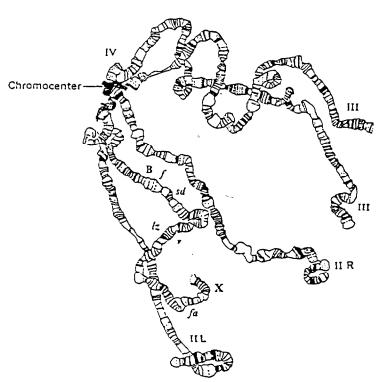


Fig. 45. Painter's first illustration of the salivary gland chromosomes of *Drosophila melanogaster*. The chromosomes are attached to the chromocenter, the X and the fourth by their ends. The two large autosomes are attached by their middles and, hence, have two arms (labelled L and R for left and right, in terms of the linkage maps). The letters show the provisional locations of some of the genes. (Painter, 1934b)

Genetics 717

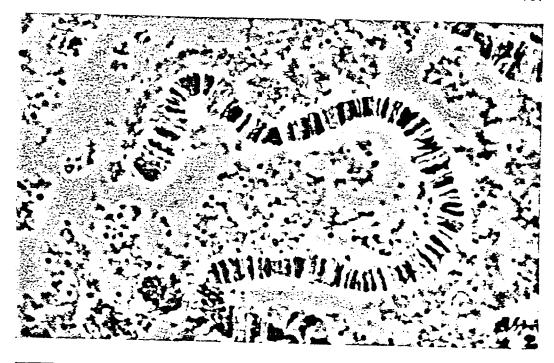




Fig. 46. Photographs of salivary gland chromosomes. The upper one is the so-called Klamath gene arrangement in *Drosophila percivilis*. The lower figure shows the area of the inversion of an individual heterozygous for the Pikes Peak and Standard gene arrangements in *Drosophila pseudoobscura*. The chromosomes at the bottom left are fused but slightly above the inversion begins—it can be seen that the bands do not correspond and pairing is not possible. One of the inverted sections makes a twist and can pair, as in the topmost section. Farther on the two homologues are separate but at the bottom right their loci are the same and pairing is possible again. (Photographs by Betty C. Moore)